Name: …… ( ) Class: Sec

St. Gabriel's Secondary School

2024 'N' Preliminary Examination

Subject : Science (Chemistry)
Paper No. : 5105/04
Level/Stream : Sec 4 Normal (Academic)
Duration : 1 hour 15 minutes (Papers 3 and 4)
Date : 07 August 2024

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class clearly in the spaces above.
Write in dark blue or black ink on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided.

Section B
Answer any **one** question.
Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.
In calculations you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than 30 minutes on Paper 3.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
A copy of the Periodic Table is printed on page 11.

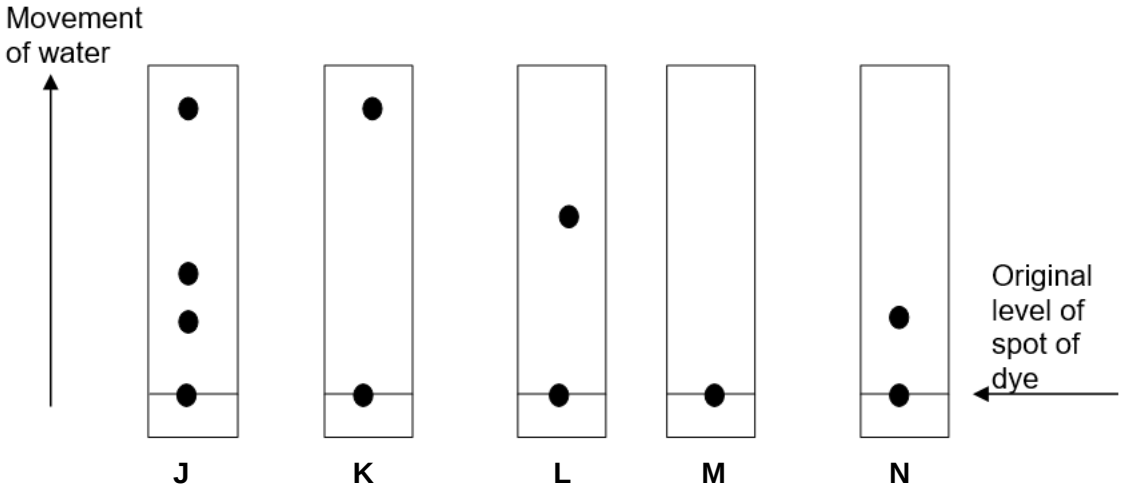
At the end of the examination hand in your answers to Paper 3 and Paper 4 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use		
	Paper 3	/20
Paper 4	Section A	/22
	Section B	/8
	Total	/50

Section A (22 marks)

Answer **all** questions.

1 **J** is a mixture of dyes. It has been suggested that **J** might be used as a food colouring. Paper chromatography was used to identify the dyes in **J**. The resulting chromatograms are shown below. Dyes **K**, **L**, **M** and **N** are safe for consumption.



(a) Which of the dyes **K**, **L**, **M** and **N** are present in **J**? ……..... [1]

(b) Which of the dyes is insoluble in water? ……..... [1]

(c) It is suggested that mixture **J** can be used as a food colouring.

Do you agree with the suggestion?

Use the information given to explain your answer.

……

…… [1]

(d) Dye **M** contains two components. Suggest how you can change this chromatographic technique so as to separate these components.

…… [1]

[Total: 4]

2 **(a)** **(i)** Complete the table for the two isotopes of chlorine.

chlorine	mass number	number of protons in nucleus	number of neutrons in nucleus
^{35}Cl		17	
^{37}Cl	37		20

[2]

(ii) Explain why ^{35}Cl and ^{37}Cl are isotopes.

……..

……..

…… [1]

(b) Sodium, proton number 11, and chlorine, proton number 17, react together to form sodium chloride.

(i) Write the chemical formula for sodium chloride.

…… [1]

(ii) Draw a 'dot and cross' diagram to show the bonding in sodium chloride.

Show only the outer shell electrons.

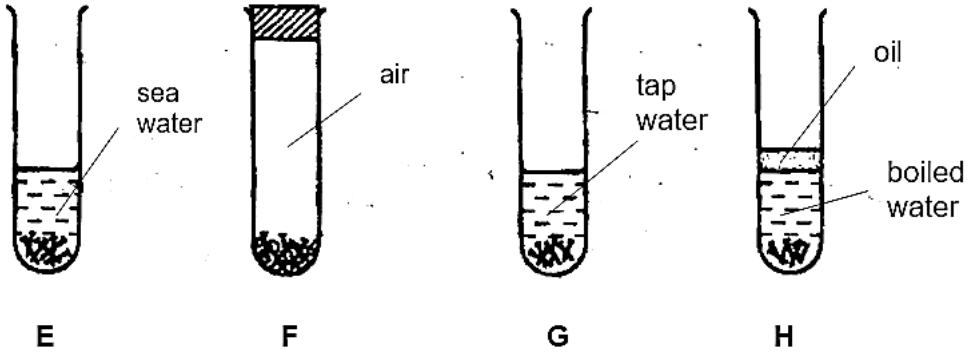
[2]

(iii) Name the type of bonding in sodium chloride.

…… [1]

[Total: 7]

3 A student carried out an experiment to investigate the conditions required for iron to rust.



The student weighed the nails at the start of the experiment and at the end of one week.

The initial mass of the nails in each test tube was 4.0 g.

The masses of the nails after one week were 4.0 g, 4.2 g, 4.4 g and 4.9 g.

(a) Fill in the masses of the nails in the table correctly.

test tube	**E**	**F**	**G**	**H**
mass of nails after one week / g				

[1]

(b) Explain why the mass of the nails in one of the test tubes remains unchanged after one week.

……

…… [1]

(c) If the nails were not weighed after one week, what other physical evidence is there to show that the nails have rusted?

…… [1]

(d) Suggest **one** practical way to prevent iron nails from rusting.

…… [1]

[Total: 4]

4 Crystals of copper(II) sulfate, $CuSO_4$ can be prepared using the method shown in Fig. 4.1.

Fig. 4.1 shows the first three steps used to prepare the crystals.

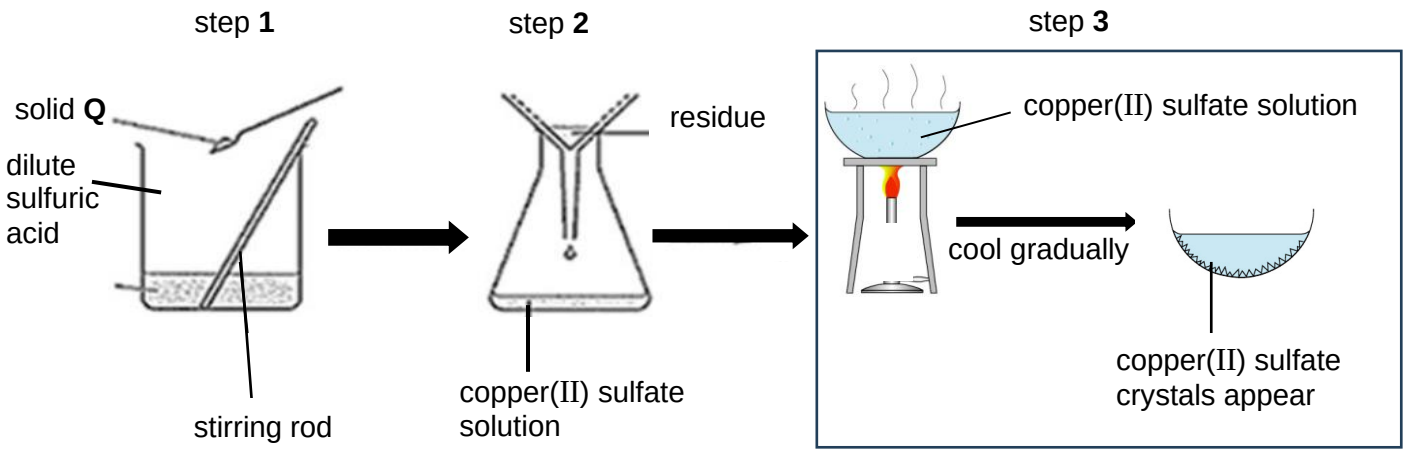


Fig. 4.1

(a) Name solid **Q**, a substance which can be added to sulfuric acid to form copper(II) sulfate.

…… [1]

(b) Name a suitable apparatus that can be used to measure 50.0 cm^3 of the sulfuric acid for step **1**.

…… [1]

(c) Name the separation methods used in step **2** and step **3**

step **2** ……..

step **3** …….. [2]

(d) What is the purpose of heating the solution gently in step **3**?

…… [1]

(e) Insoluble salts like silver chloride, can be prepared by precipitation reaction.

The equation shows the reaction between silver nitrate and sodium chloride to form precipitate, silver chloride.

$$AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$$

(i) Calculate the relative formula mass of silver chloride.

relative formula mass = ……... [1]

(ii) At the end of the reaction, 50 g of silver chloride is formed.

Calculate the number of moles of silver chloride formed at the end of the reaction.

number of moles of silver chloride = …….. mol [1]

[Total: 7]

Section B (8 marks)

Answer **one** question from this section.

5 Six hydrocarbons are identified by the letters **U**, **V**, **W**, **X**, **Y** and **Z**.

Fig. 5.1 shows how the relative molecular masses of these hydrocarbons vary with the number of carbon atoms in each of their molecules.

Five of these hydrocarbons are in the same homologous series.

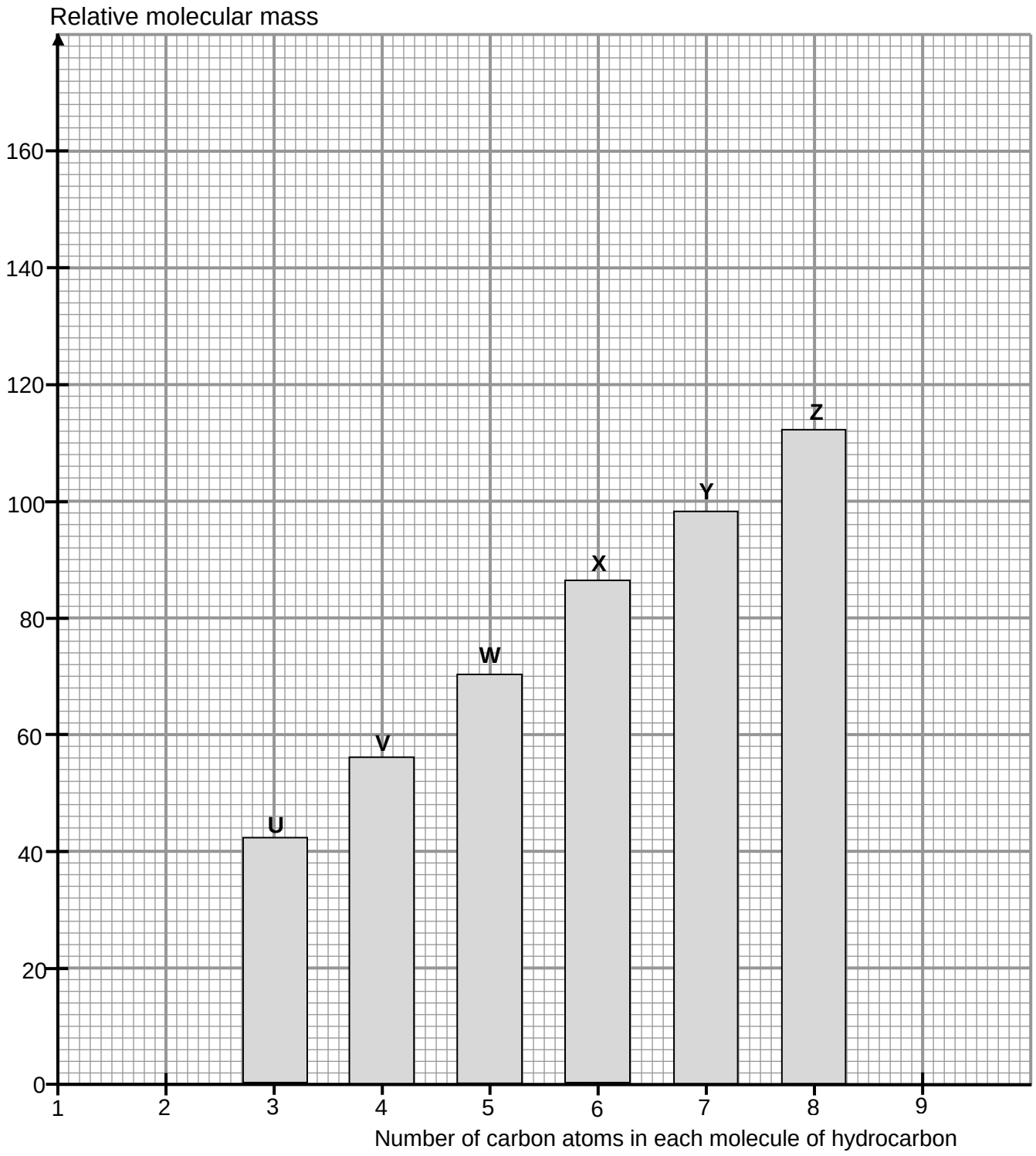


Fig. 5.1

(a) Hydrocarbon **U** has a relative molecular mass of 42. Suggest the name of this hydrocarbon.

……. [1]

(b) Which hydrocarbon, **U**, **V**, **W**, **X**, **Y** or **Z** is not a member of the same homologous series as the other five?

Explain your answer.

……

……

……

……. [2]

(c) Write down the general formula of the homologous series of the five hydrocarbons.

……. [1]

(d) Complete the bar chart in Fig. 5.1 for the next hydrocarbon with 9 carbon atoms. [1]

(e) Name the products formed when the hydrocarbons undergo complete combustion.

……. [1]

(f) Describe a chemical test to distinguish a saturated hydrocarbon from an unsaturated hydrocarbon.

test: ……

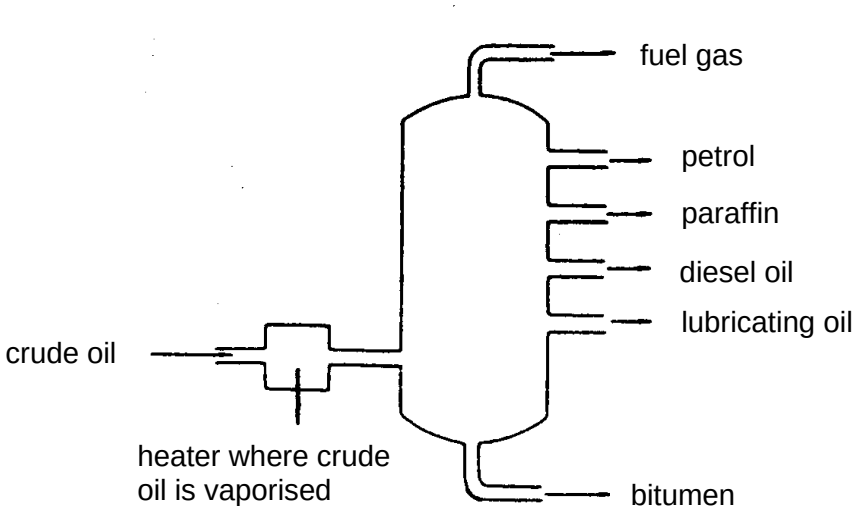
results: …….

……

……. [2]

[Total: 8]

6 The diagram shows how crude oil is separated into its fractions.



(a) **(i)** Name the process used to separate crude oil into its fractions.

…… [1]

(ii) Which fraction has the highest boiling point?

Explain your answer.

……..

…… [2]

(b) After crude oil has been separated, some of the large hydrocarbon molecules can be broken into smaller molecules. An example of this is represented by the equation below.

$$C_{10}H_{22} \rightarrow \mathbf{Q} + C_2H_4$$

decane ethene

(i) Name the chemical reaction.

…… [1]

(ii) Deduce the molecular formula of **Q**.

…… [1]

(c) Ethene undergo polymerisation to form poly(ethene). Poly(ethene) can be used to make plastic bottles.

(i) Draw a section of poly(ethene) showing six carbon atoms.

[1]

(ii) Poly(ethene) can be recycled using the physical method or the chemical method. Explain why poly(ethene) are recycled.

……..

……..

……..

…… [2]

[Total: 8]

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –